Demonstration of Design and Flight Operation Methods for Reduced Vertical Take-off and Landing (VTOL) Aircraft Noise Impact

Completed Technology Project (2015 - 2020)

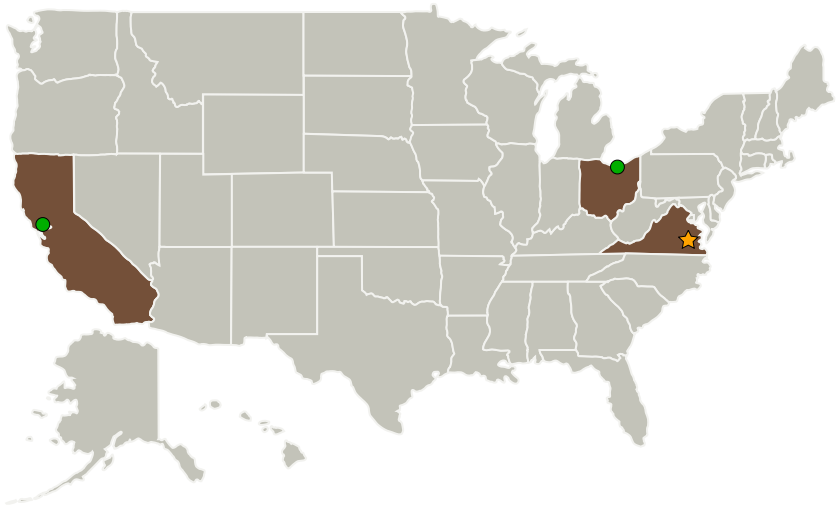
Project Introduction

The Demonstration of Design and Flight Operation Methods for Reduced Vertical Take-off and Landing (VTOL) Aircraft Noise Impact challenge was created to overcome the growth in community helicopter noise complaints, NASA will combine improved flight operations, a high-fidelity rotor/vehicle design approach, and human factors research to provide a 50% reduction in the Sound Exposure Level (SEL) footprint area for commercial VTOL vehicles in common use. This goal is targeted at vehicles that are nominally from 4-20 passengers or 2400 to 24,000 pounds gross weight, but the methods may be applicable to other vehicle sizes.

Anticipated Benefits

Increases likelihood of community acceptance and fewer noise complaints for VTOL vehicles, and therefore the likelihood of reduced restrictions placed on rotorcarft operations. Enables new design and flight operation methods that will significantly reduce the community impacts of noise while simultaneously maintaining or improving high aerodynamic performance.

Primary U.S. Work Locations and Key Partners



Demonstration of Design and Flight Operation Methods for Reduced Vertical Take-off and Landing (VTOL) Aircraft Noise Impact

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	2
Project Website:	3
Target Destination	3

Demonstration of Design and Flight Operation Methods for Reduced Vertical Take-off and Landing (VTOL) Aircraft Noise Impact

Completed Technology Project (2015 - 2020)

Organizations Performing Work	Role	Type	Location
Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Federal Aviation Administration(FAA)	Supporting Organization	US Government	Washington, District of Columbia
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Co-Funding Partners	Type	Location
Federal Aviation Administration(FAA)	US Government	Washington, District of Columbia

Primary U.S. Work Locations	
California	Ohio
Virginia	

Project Transitions

October 2015: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Aeronautics Research Mission Directorate (ARMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Advanced Air Vehicles

Project Management

Program Director:

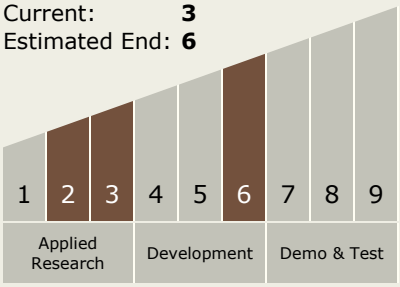
James A Kenyon

Project Manager:

Susan A Gorton

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **6**



Technology Areas

Primary:

Continued on following page.

Demonstration of Design and Flight Operation Methods for Reduced Vertical Take-off and Landing (VTOL) Aircraft Noise Impact

Completed Technology Project (2015 - 2020)

September 2020: Closed out

Closeout Summary: A capability to reduce noise through operational changes (near term impact) has been demonstrated and a validated process for designin g optimized low-noise rotors (far term impact) has been established. Annoyance metrics have been identified to assist in the design process. •The effort demonst rated a potential 60% reduction in the area covered by the 70 dB SEL contour, which is higher than the 50% reduction goal of the exit criteria. •The maturity le vel for the TC anticipated a TRL increase of 2-5. With the Fly Neighborly guidelin es created under this TC and the use of those guidelines as part of pilot training used by the HAI, the assessed TRL 6 value at the end of the TC exceeds the exp ectation. •Developed and demonstrated multidisciplinary high-fidelity design me thods that incorporate Computational Fluid Dynamics, Computational Structural Dynamics, Computational Aeroacoustics, and acoustic analyses. •Psychoacoustic testing under this TC demonstrated that either SEL or EPNL is a suitable objectiv e function when designing a rotor for reduced annoyance if other sound quality metrics are not significantly affected.

Project Website:

https://www.nasa.gov/aeroresearch/programs/aavp/rvlt

Technology Areas *(cont.)*

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.4 Aeroacoustics

Target Destination

Earth